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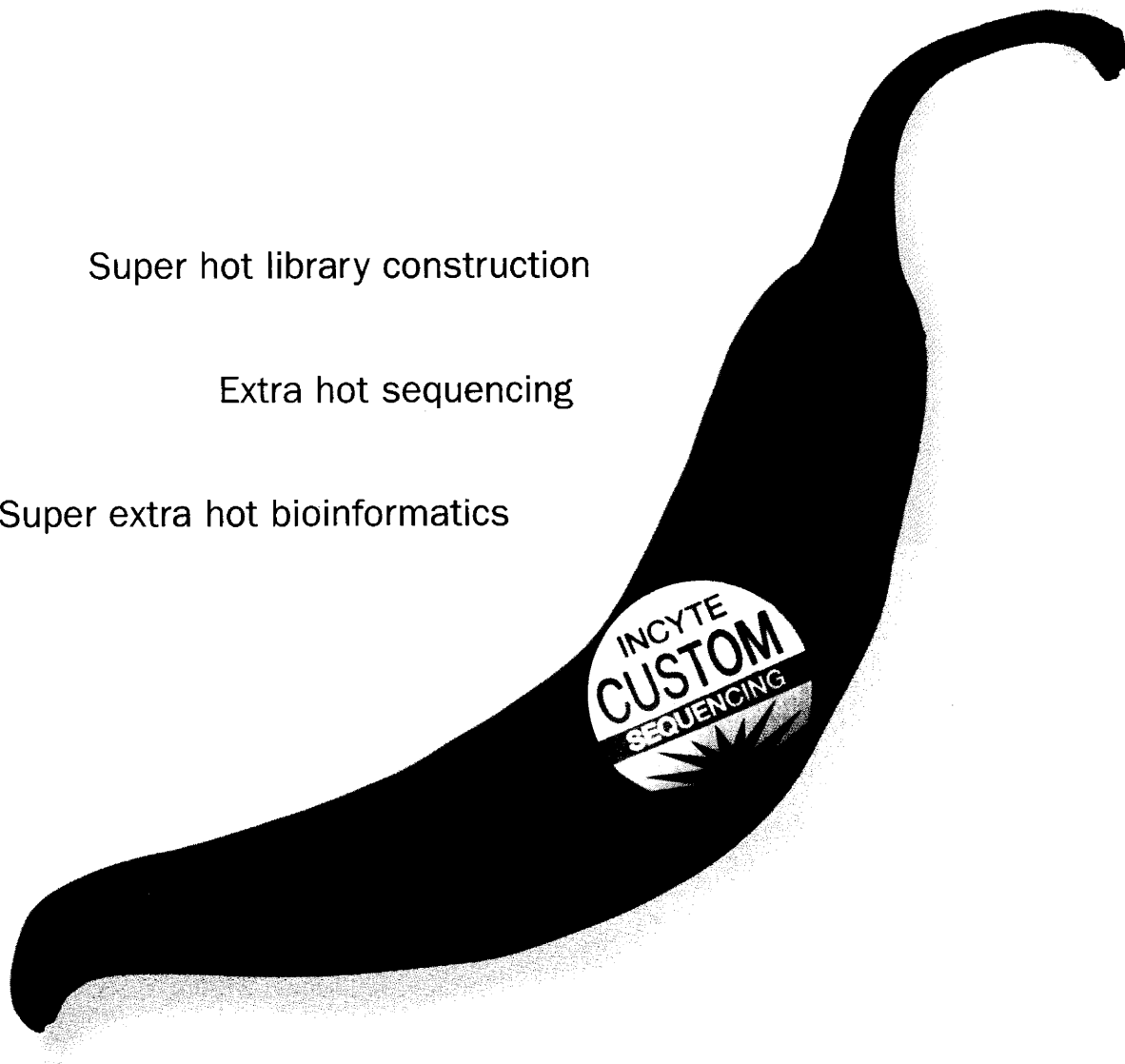
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Science

Volume 291 16 March 2001 Number 5511

2041 **SCIENCE ONLINE**
2043 **THIS WEEK IN SCIENCE**
2047 **EDITORIAL**
P. Balvanera, G. C. Daily,
P. R. Ehrlich, T. H. Ricketts,
S.-A. Bailey, S. Kark, C.
Kremen, H. Pereira
*Conserving Biodiversity
and Ecosystem Services*

2049 **EDITORS' CHOICE**
2053 **NETWATCH**
2056 **CONTACT SCIENCE**
2175 **TECH.SIGHT/NEW PRODUCTS**
Spectroscopy

NEWS



2074

Supercentenarians

NEWS OF THE WEEK

- 2060 **FINANCIAL CONFLICT:** Universities Puncture Modest Regulatory Trial Balloon
- 2060 **PARKINSON'S RESEARCH:** Fetal Cell Transplant Trial Draws Fire
- 2061 **HUMAN CLONING:** Experts Assail Plan to Help Childless Couples
- 2063 **GENDER EQUITY:** NSF Program Targets Institutional Change
- 2063 **SCIENCE SCOPE**
- ▼2064 **NEUROSCIENCE:** Dyslexia: Same Brains, Different Languages
2165
- 2065 **CELL BIOLOGY:** How Bacterial Flagella Flip Their Switch
- 2067 **ASTRONOMY:** Stars Rise From Ashes in Globular Cluster

NEWS FOCUS

- 2068 **INNATE IMMUNITY:** Ancient System Gets New Respect
Engineering Protection for Plants
- 2071 **BIOPHYSICAL SOCIETY:** Crossover Research Yields Scents and Sensitivity
- 2073 **RESEARCH COLLABORATIONS:** NASA Lab Offers Land to Lure Research Partners
- 2074 **DEMOGRAPHY:** Sardinia's Mysterious Male Methuselahs
An Island of 'Genetic Parks'
- 2077 **NEUROBIOLOGY:** Does Alcohol Damage Female Brains More?
- 2081 **RANDOM SAMPLES**

SCIENCE'S COMPASS

2089 LETTERS

Deterring Bioweapons Development M. Wheelis.
Moribund Funding in Agricultural Research G. P. Robertson, P. J. Barry, F. F. Busta, R. J. Collier, N. T. Keen, R. R. Sederoff, W. W. Simpkins, F. Stormshak, T. N. Urban. **Porous Sediments at the Top of Earth's Core?** S. A. Morse.
Response B. Buffett, E. Garnero, R. Jeanloz. **Tale of Two Kings** C. Sumen; Editors' Note

POLICY FORUM

- 2095 **CLIMATE CHANGE:** Whither After The Hague? K. Töpfer

BOOKS ET AL.

- 2097 **POLITICAL SCIENCE:** *The Deadly Ethnic Riot* D. L. Horowitz, reviewed by S. Kakar
- 2097 **ASTRONOMY:** *Star Struck 1000 Years of the Art and Science of Astronomy* R. Brashear and D. Lewis, Curators, and *Star Struck One Thousand Years of the Art and Science of Astronomy* R. Brashear and D. Lewis, reviewed by V. Trimble

- 2098 **Browsings**

PERSPECTIVES

- ▼2099 **DEVELOPMENT:** How to Stimulate Your Partner A. M. Villeneuve
2144
- 2101 **GEOLOGY:** The Deadliest Intraplate Earthquake H. K. Gupta, N. P. Rao, B. K. Rastogi, D. Sarkar
- 2102 **TRANSDUCTION:** When Worlds Collide—Trafficking in JNK L. S. B. Goldstein
- ▼2104 **ECOLOGY:** The Enemy of My Enemy Is My Ally M. W. Sabelis, A. Janssen, M. R. Kant
2141
- ▼2105 **CHEMISTRY:** A Light-Driven Linear Motor at the Molecular Level J.-P. Sauvage
2124
- ▼2106 **CHEMISTRY:** Water on the Move M. L. Klein
2118
2121
- 2107 **RETROSPECTIVE:** Herbert A. Simon, 1916–2001 E. A. Feigenbaum



2104

Repelling hungry herbivores



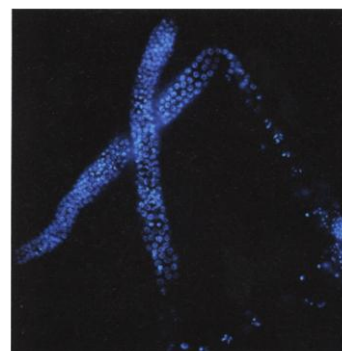
2115

Attractive cobalt nanoparticles



COVER 2138

The Chinese character for "light" on an *Arabidopsis* leaf. This image was created by exploiting the plant chloroplasts' protective response to strong light. Upon selective irradiation of the area within the character, chloroplasts in this region move from the cell surface to the side walls when light is detected by the blue light receptor NPL1. The leaf surface then appears paler in color in the irradiated area. [Image: M. Wada]



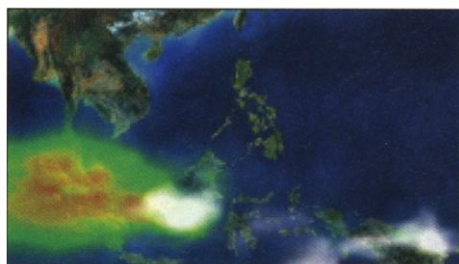
2144

Sperm coaxes eggs as well as chase them

RESEARCH

REPORTS

- 2115 Colloidal Nanocrystal Shape and Size Control: The Case of Cobalt** V. F. Puentes, K. M. Krishnan, A. P. Alivisatos
- ▼ **2118 Dynamics of Water Molecules in Aqueous Solvation Shells** M. F. Kropman and H. J. Bakker
2106
2121
- ▼ **2121 Autoionization in Liquid Water** P. L. Geissler, C. Dellago, D. Chandler, J. Hutter, M. Parrinello
2106
2118
- ▼ **2124 Photoinduction of Fast, Reversible Translational Motion in a Hydrogen-Bonded Molecular Shuttle** A. M. Brouwer, C. Frochot, F. G. Gatti, D. A. Leigh, L. Mottier, F. Paolucci, S. Roffia, G. W. H. Wurfel
2105
- 2128 Tropical Tropospheric Ozone and Biomass Burning** A. M. Thompson, J. C. Witte, R. D. Hudson, H. Guo, J. R. Herman, M. Fujiwara
- 2132 Synchronous Tropical South China Sea SST Change and Greenland Warming During Deglaciation** M. Kienast, S. Steinke, K. Stettenger, S. E. Calvert
- 2135 Role of the ABC Transporter Mdl1 in Peptide Export from Mitochondria** L. Young, K. Leonhard, T. Tatsuta, J. Trowsdale, T. Langer
- 2138 Arabidopsis NPL1: A Phototropin Homolog Controlling the Chloroplast High-Light Avoidance Response** T. Kagawa, T. Sakai, N. Suetsugu, K. Oikawa, S. Ishiguro, T. Kato, S. Tabata, K. Okada, M. Wada
- ▼ **2141 Defensive Function of Herbivore-Induced Plant Volatile Emissions in Nature** A. Kessler and I. T. Baldwin
2104
- ▼ **2144 A Sperm Cytoskeletal Protein That Signals Oocyte Meiotic Maturation and Ovulation** M. A. Miller, V. Q. Nguyen, M.-H. Lee, M. Kosinski, T. Schedl, R. M. Caprioli, D. Greenstein
2099
- 2147 Sonic Hedgehog Control of Size and Shape in Midbrain Pattern Formation** S. Agarwala, T. A. Sanders, C. W. Ragsdale
- 2150 Structure of an Extracellular gp130 Cytokine Receptor Signaling Complex** D. Chow, X. He, A. L. Snow, S. Rose-John, K. C. Garcia
- 2156 5'-Deoxyribose Phosphate Lyase Activity of Human DNA Polymerase ϵ in Vitro** K. Bebenek, A. Tissier, E. G. Frank, J. P. McDonald, R. Prasad, S. H. Wilson, R. Woodgate, T. A. Kunkel
- 2159 An RNA Ligase Essential for RNA Editing and Survival of the Bloodstream Form of *Trypanosoma brucei*** A. Schnauffer, A. K. Panigrahi, B. Panicucci, R. P. Igo Jr., R. Salavati, K. Stuart
- 2162 Defective Lymphotoxin- β Receptor-Induced NF- κ B Transcriptional Activity in NIK-Deficient Mice** L. Yin, L. Wu, H. Wesche, C. D. Arthur, J. M. White, D. V. Goeddel, R. D. Schreiber
- ▼ **2165 Dyslexia: Cultural Diversity and Biological Unity** E. Paulesu, J.-F. Démonet, F. Fazio, E. McCrory, V. Chanoine, N. Brunswick, S. F. Cappa, G. Cossu, M. Habib, C. D. Frith, U. Frith
2064



2128

Ozone and smoke signals



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Ancient Geodynamics and Global-Scale Hydrology on Mars

R. J. Phillips *et al.*

Massive volcanism may have built the Tharsis rise on Mars by about four billion years ago and created a warmer climate that allowed liquid water to form some of the observed valley networks.

Dynamics of the Vocal Imitation Process: How a Zebra Finch Learns Its Song

O. Tchernichovski, P. P. Mitra, T. Lints, F. Nottebohm

PERSPECTIVE: **The Song Does Not Remain the Same** D. Margoliash

How do zebra finches download songs and learn to sing?

Role of Histone H3 Lysine 9 Methylation in Epigenetic Control of Heterochromatin Assembly

J. Nakayama, J. C. Rice, B. D. Strahl, C. D. Allis, S. I. S. Grewal

Methylation of the tail of histone H3 at lysine 9 leads to the assembly of heterochromatin and epigenetic gene silencing.

TECHNICAL COMMENTS

O₂⁻ Ions and the Mars Labeled Release Response

Reporting on experiments under simulated martian conditions, Yen *et al.* (Reports, 15 Sep. 2000; p. 1909) argued that formation of superoxide radicals constitutes "the most straightforward explanation" for the martian soil's unusual reactivity and for the apparent absence of organic molecules at the martian surface. Levin comments that their results "differ sharply" from control data from the Viking labeled release (LR) life detection experiments, which showed a temperature-dependent inactivation of martian samples on heating, and that additional LR data not mentioned by Yen *et al.* challenge the notion that superoxides constitute the reactive agent in the martian soil, leaving intact the possibility that "living microorganisms were detected in the LR experiment." Yen *et al.* respond that the heated soils in the Viking experiments "released up to 0.2 weight percent water"—more than enough to scavenge reactive oxygen species—and propose alternative explanations for the additional data cited by Levin.

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/291/5511/2041a

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Connections Map: *Drosophila* Wnt Pathway N. Perrimon and M. Boutros

Wnt signal transduction in the fly *Drosophila melanogaster*.

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UK: Super Conferencing—Get the Most from Your Meeting P. H. Dee

Spotting top contacts, encouraging new ideas, networking like crazy—our "Yours Transferably" columnist lets you in on the secrets of a truly effective conference experience.

Canada: ABC—A Fun Lesson in Mentoring L. McKarney

The Aventis Biotech Challenge gives high-school students in Canada a chance to participate in research, but it's also a great way for scientists to hone their mentoring skills.

US: CPST Comments E. Babco

Our occasional job market news update includes information on opportunities in geology, the life sciences, and chemistry, as well as articles on graduate enrollment, retention of women faculty, and R&D spending at U.S. universities.

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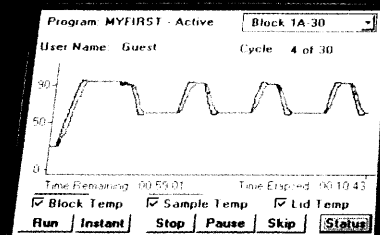
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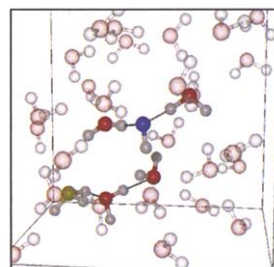
edited by Phil Szuromi

Smoke and Ozone

Smoke aerosol and ozone are both produced by biomass burning. A strong link between elevated tropospheric ozone and biomass burning has been shown particularly for southern Africa, but other studies have indicated that tropospheric ozone is driven by large-scale atmospheric dynamics and by lightning. Thompson *et al.* (p. 2128) have analyzed daily satellite measurements of aerosol and ozone in the troposphere for August 1996 to December 1998 and show that tropospheric ozone increased well before the large fires in Indonesia connected with El Niño. Comparison of these data with earlier records from the 1980s shows that smoke and ozone signals were generally decoupled, indicating that biomass burning is only one factor determining tropical tropospheric ozone.

Water Workings

Ions may dissolve readily in water, which itself autoionizes into H_3O^+ and OH^- ions. Two reports focus on the complexity underlying these apparently simple processes (see the Perspective by Klein). Water forms solvation shells around dissolved ions, but gaining detailed insights into the structure and properties of these shells is difficult because their signature cannot easily be separated from that of the surrounding bulk water. Kropman and Bakker (p. 2118) have used nonlinear mid-infrared spectroscopy overcome this problem and find that the motion of the solvation shell is sluggish compared to that of the bulk liquid—removing a water molecule causes the shell to break down and is thus associated with a high energy cost. In contrast, breaking of a hydrogen bond in the bulk can be compensated easily by the simultaneous formation of a new one. Another well-known property of water, its autoionization that governs its pH constant, has been even more intractable at the molecular level. Some proportion of water molecules dissociates in liquid water, but individual events are rare. Geissler *et al.* (p. 2121) combined high-accuracy *ab initio* molecular dynamics calculations with a method for efficient sampling of the liquid water potential energy surface. They then elucidated a mechanism of autoionization that combines fluctuations in the long-range electrostatic interactions with hydrogen-bond dynamics. Ions produced in this way usually recombine quickly, but when the fluctuation coincides with the breaking of the hydrogen-bond wire, the system crosses a transition state and rapid recombination cannot take place.



2115 Controlling Cobalt Nanoparticles

Recently a strategy has been described for obtaining highly uniform nanoparticles, called size-distribution focusing, in which the nucleation and growth processes are separated during synthesis. Combined with the use of surfactants that bind preferentially to different growth faces, the size and shape of CdSe particles could be controlled. Puntès *et al.* (p. 2115) now report that this approach can be applied to the synthesis of single-crystalline Co nanoparticles and nanorods, which are of special interest for their size- and shape-dependent magnetic properties. These magnetic particles organize into two- and three-dimensional superstructures.

Shuttle Snapshot

Several examples of molecular "shuttles" have been reported in which a molecular ring threaded onto a linear molecule can move back and forth between different positions. Brouwer *et al.* (p. 2124; see the Perspective by Sauvage) studied the dynamics of the cycling of a rotaxane molecule between two different hydrogen-bonded "stations" driven by pulsed-laser

excitation. In acetonitrile solvent, transient optical absorption spectroscopy shows that the photon-induced motion occurs in about 1 microsecond. Charge recombination causes the rotaxane to shuttle back, a process that takes about 100 microseconds. ✕

Two-Way Trade

Mitochondria, the powerhouses of the cell, are semi-autonomous organelles that possess their own limited genome. Much is known about the import of proteins manufactured in the cytosol into these organelles. Young *et al.* (p. 2135) now report an unexpected observation—mitochondria from the yeast *Saccharomyces cerevisiae* can export peptides through a membrane peptide transporter. The role of peptide export is still unclear but may potentially allow communication between mitochondria and the rest of the cell.

Avoiding the Noon Day Sun

Chloroplasts of the plant *Arabidopsis* convert light to metabolic energy—up to a point. When the incident light is simply too intense, the chloroplasts shuffle off to the sides of the cell to find some shade near the adjacent cells walls. Under more moderate light conditions, the chloroplasts spread out over the face of the cell to capture as many photons as possible. Kagawa *et al.* (p. 2138; see the cover) have now identified a protein that helps regulate this process, NPL1, that resembles a known blue-light photoreceptor. Thus, the plant appears to fine-tune and protect its light-harvesting capabilities by using photoreceptors to direct subcellular compartmentalization.

Calling in Your Allies

When attacked by herbivores, some plants are known to emit volatile compounds that attract predators of the herbivores. However, these indirect defenses have been demonstrated only in artificial laboratory and agricultural situations. Kessler and Baldwin (p. 2141; see the Perspective by Sabelis *et al.*) show that such systems also operate under natural conditions. Using plants of *Nicotiana attenuata* growing in the Great Basin Desert in Utah, they directly manipulated individual components of the suite of

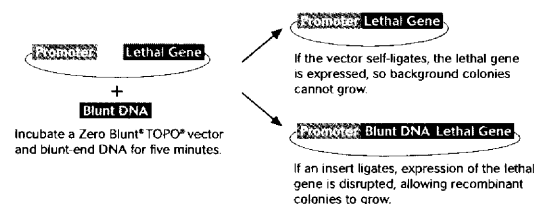
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Figure 1 - Positive Selection



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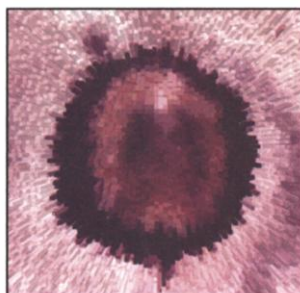
volatile organic compounds released after herbivore attack by *Manduca* caterpillars. They identified compounds that dramatically increased attack by the caterpillar's predators and that also reduced the oviposition rate of the *Manduca* moth. Thus, the plant can exert both "bottom-up" and "top-down" control of its enemies.

Doing More Than Locomotion

The major sperm cytoskeletal protein (MSP) functions in the crucial role of locomotion. Miller *et al.* (p. 2144; see the Perspective by Villeneuve) found that in the nematode, MSP also executes another critical step in reproduction—inducing the female's oocyte to come out of the arrest phase and mature. These results suggest that other proteins with MSP-like domains, which are found in plants, fungi, and other animals, may also have a signaling role.

Brains Take Shape

What gives a tissue or organ its stereotypic size, shape, and orientation? Experiments by Agarwala *et al.* (p. 2147) now help to elucidate the molecular mechanism underlying the formation of different brain tissues. They altered the size, shape, and orientation of the Sonic Hedgehog morphogen in the developing chick brain and show that this signaling molecule can control the size, shape, and orientation of characteristic brain structures. ✕



Editing Is Essential

In the process known as RNA editing, some messenger RNAs are chemically modified after they are synthesized and before they are translated into proteins. Editing was first discovered in the mitochondrial RNAs of trypanosomes, in which a large protein complex catalyzes the insertion and deletion of several uridine residues, which are specified by small guide RNA molecules. Schnauffer *et al.* (p. 2159) have demonstrated that a component of this complex is an RNA ligase that functions during the bloodstream phase of the parasite life cycle and that repression of this ligase results in parasite death, which suggests that inhibitors of this complex may be useful chemotherapeutic agents. ✕

Mixed Signals

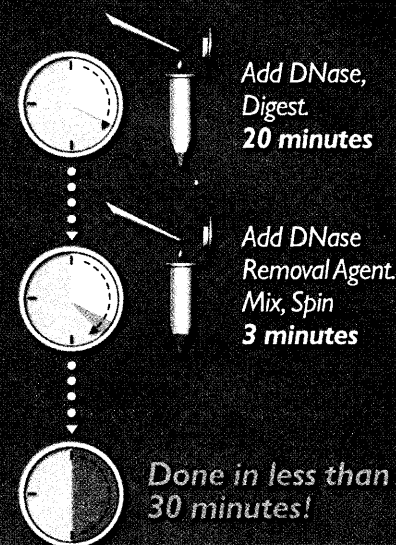
Multiple signaling pathways converge on the transcription factor NF- κ B, which results in the expression of a range of genes. One of the upstream kinases that can activate NF- κ B is NF- κ B-inducing kinase (NIK), an enzyme that has been implicated in the selective gene expression in response to discrete signals received at the cell surface. Yin *et al.* (p. 2162) studied cytokine-induced transcriptional activity of NF- κ B in mice carrying a targeted disruption of the NIK locus and observed the selective loss of transcription, but not NF- κ B-DNA binding, in response to signals delivered through the lymphotoxin- $\alpha\beta$ receptor (LT $\alpha\beta$ -R). This effect, which was not seen in response to related cytokines, namely tumor necrosis factor and interleukin-1, correlated directly with disruption to the development of lymphoid tissue already reported in mice deficient in LT $\alpha\beta$ -R.

Cultural Influences on Reading

Dyslexia is a complex disorder that causes different degrees of impairment in reading and that also varies in prevalence across cultures. Paulesu *et al.* (p. 2165; see the news story by Helmuth) have undertaken a cross-cultural study of dyslexic individuals in Italy, France, and the United Kingdom by utilizing behavioral tests and brain imaging scans. They confirm earlier findings that languages with shallow orthographies (where letters map onto sounds in a one-to-one manner), such as Italian, result in less severe impairment. Nevertheless, the underlying neural activation patterns are consistent across dyslexic subjects in all three countries: There is reduced activity in the left temporal cortex, which suggests there may be fewer or less stereotyped connections among brain regions than is observed during reading in normal individuals.

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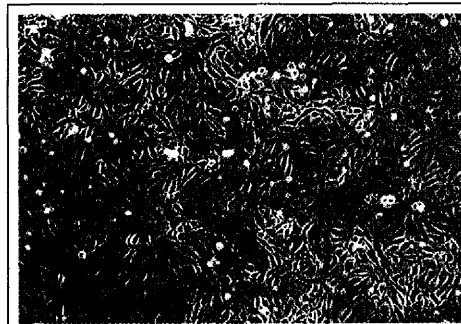
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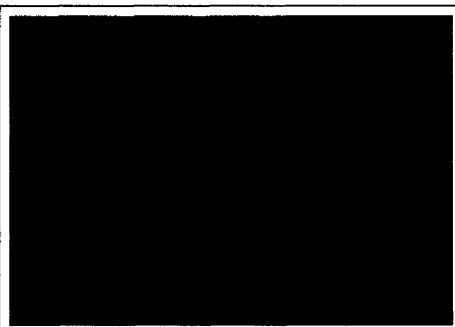
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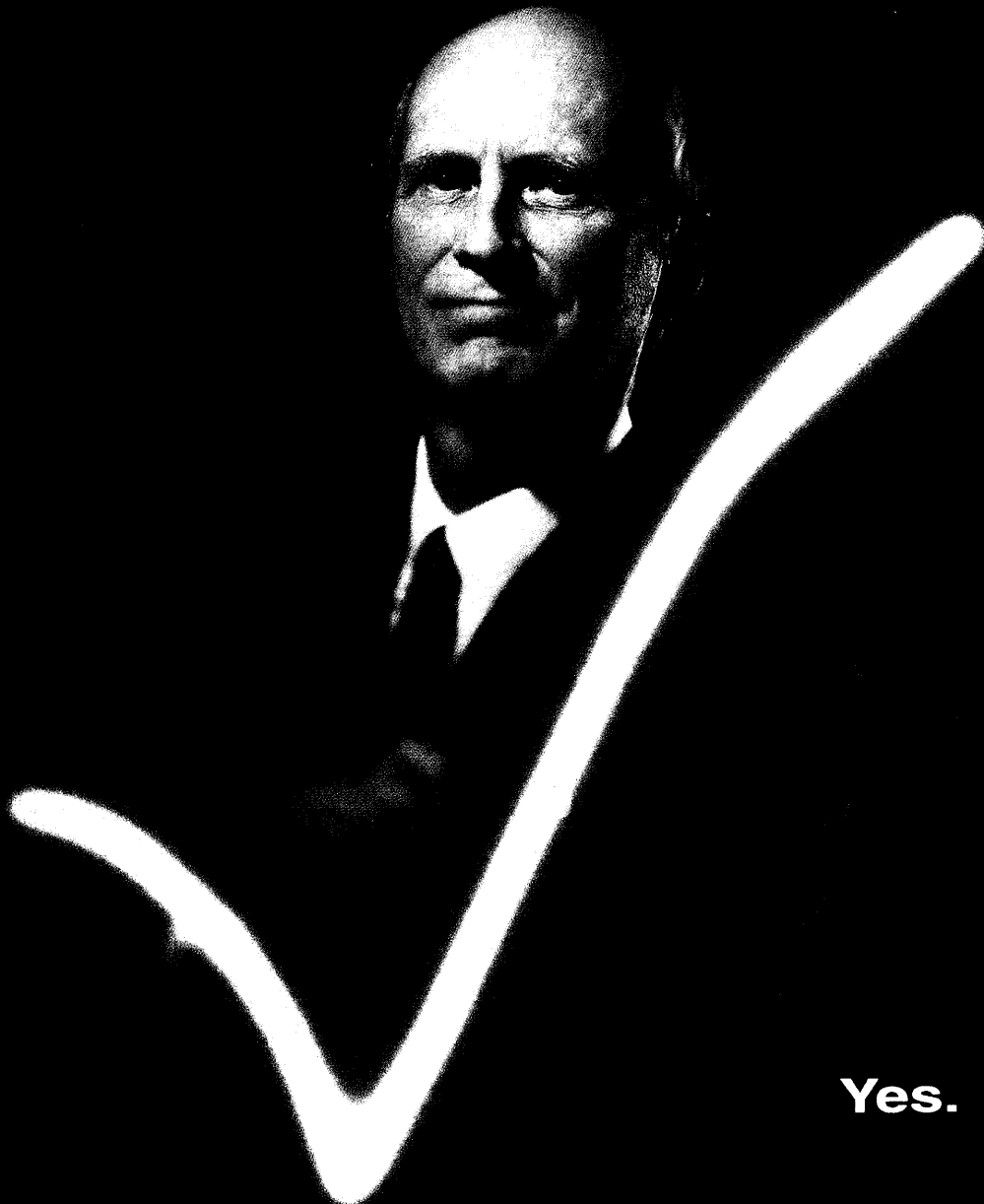
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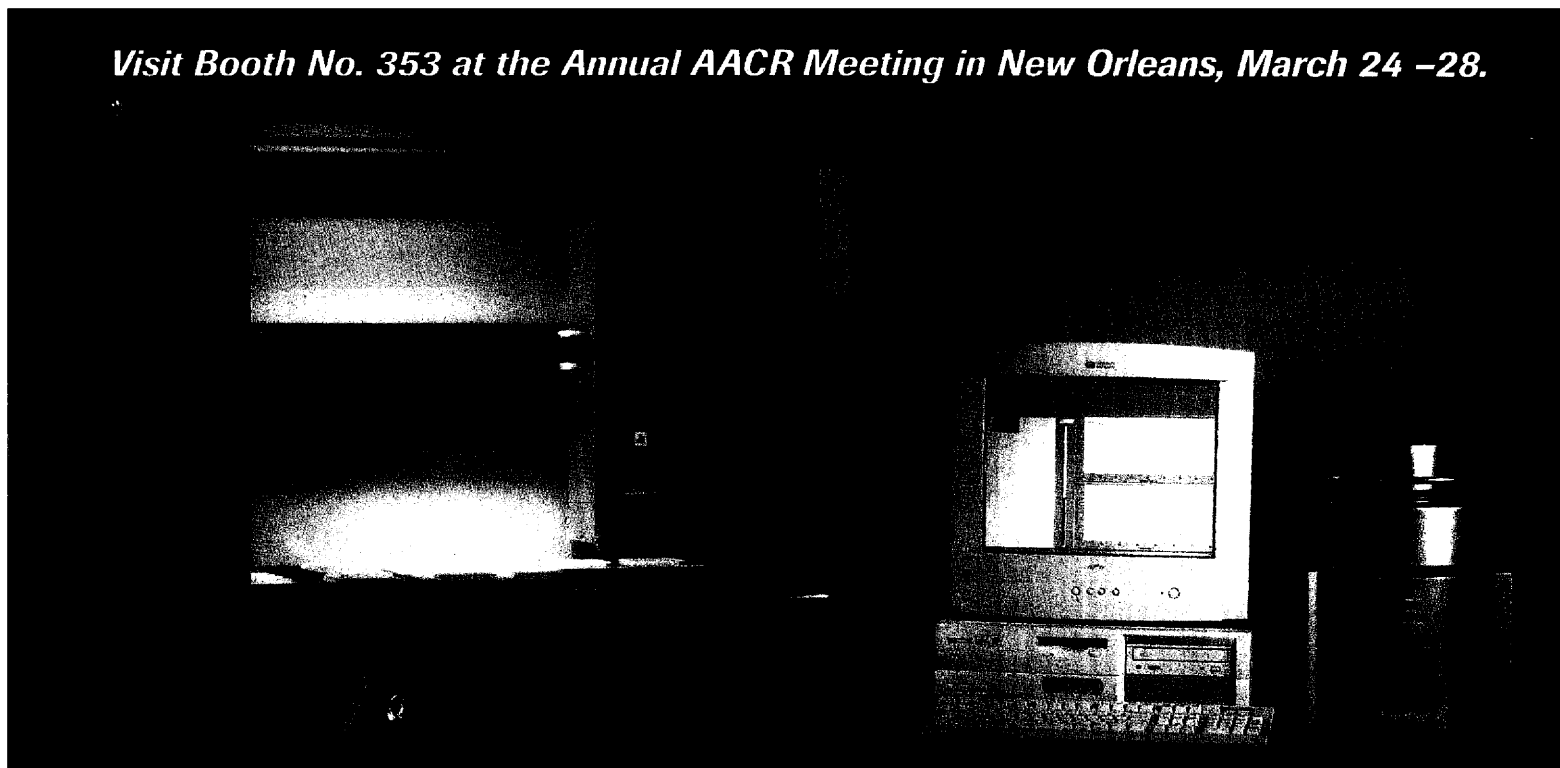
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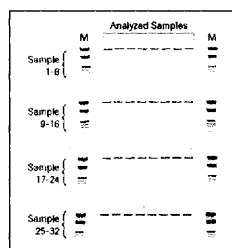
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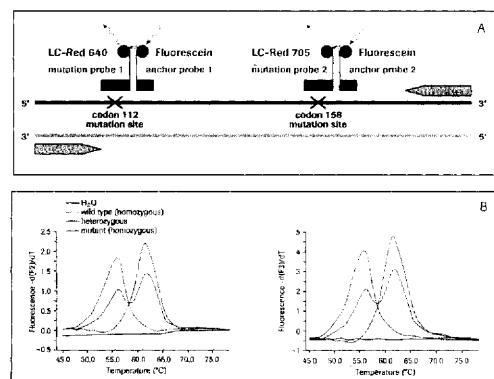
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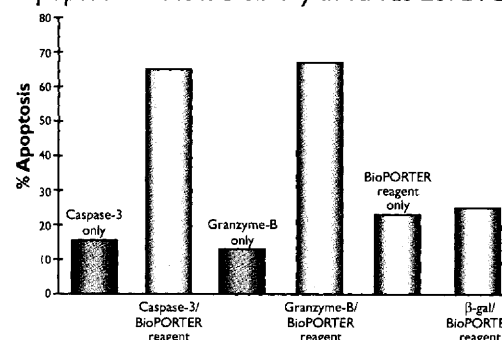
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Apoptotic Protein Delivery in Ki-ras 267B1 Cells



Granzyme B (450 ng), Caspase-3 (3.3 ng) or β -galactosidase (2 μ g) were added to Ki-Ras 267 cells (prostate cancer) with or without BioPORTER reagent. 24 hours after protein delivery, cells were directly analyzed for apoptosis by flow cytometry using an Annexin V-FITC assay kit.

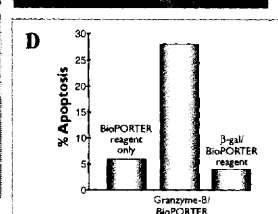
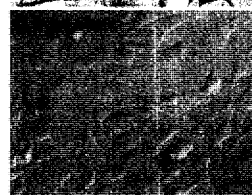
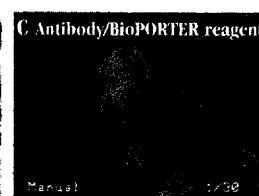


Fig. B/C FITC-Antibody or β -gal Delivery Into Mouse Fibroblasts
FITC-labeled antibody (2 μ g) or β -gal (0.5 μ g) were delivered with 2.5 μ l of BioPORTER reagent into NIH/3T3 cells grown on coverslips in serum free conditions. Cells were examined 4 hours after protein delivery.

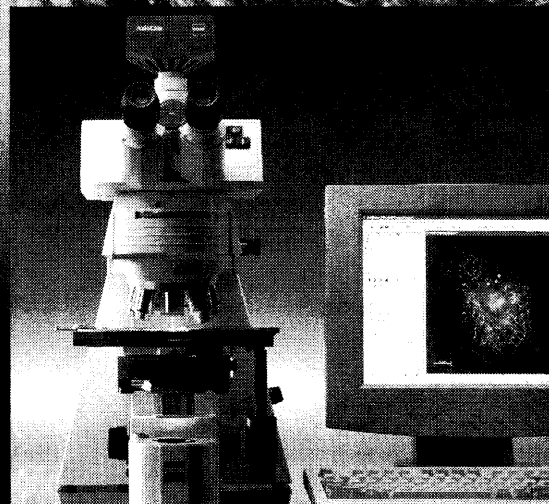
Fig. D Functional Granzyme-B Delivery Into Jurkat Cells
Granzyme-B (450 ng) or β -gal (1 μ g) were delivered into cells growing in serum-free medium. 24 hours after protein delivery, cells were directly analyzed for apoptosis by flow cytometry using Annexin V-FITC.

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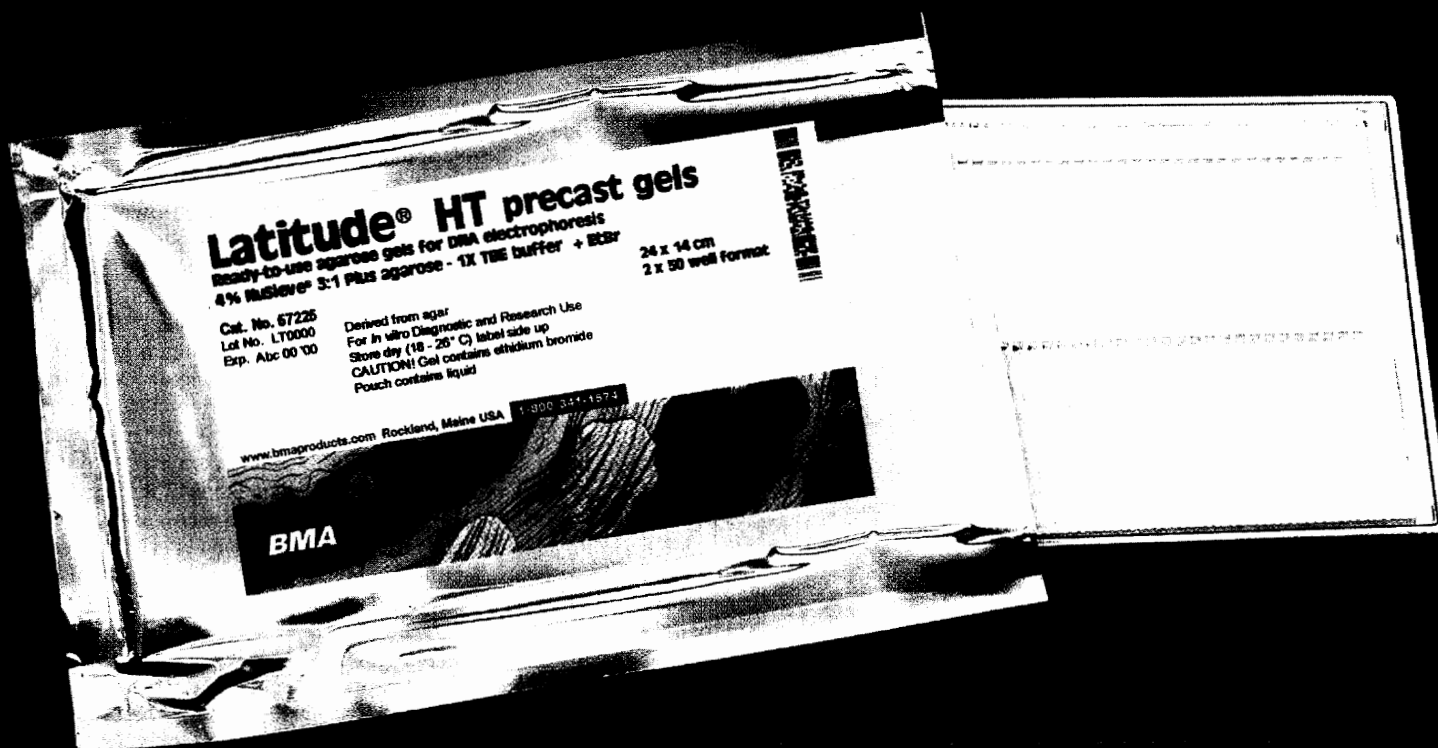
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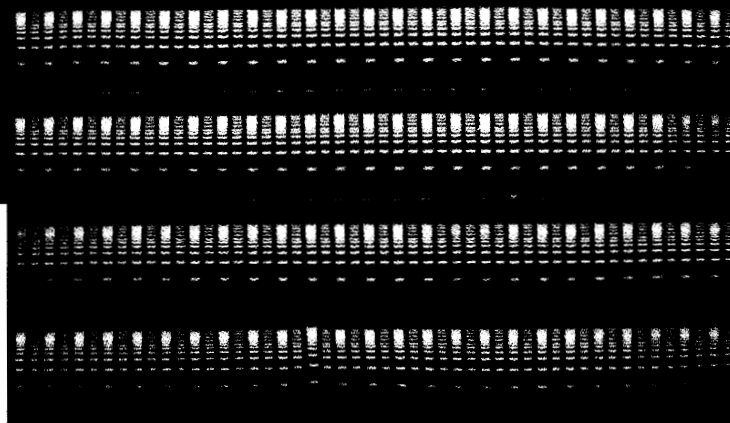


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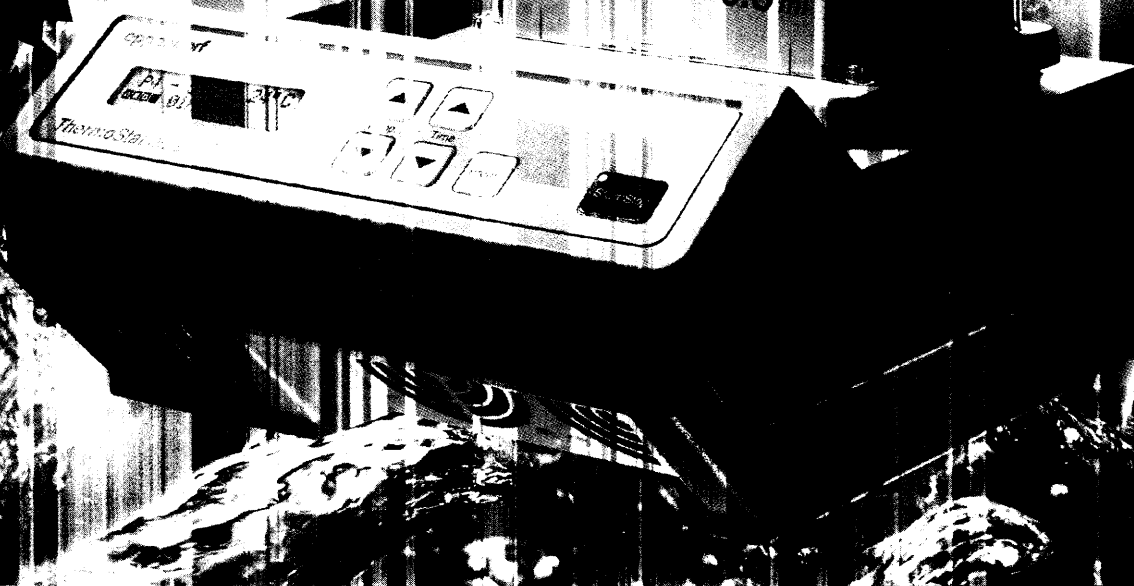
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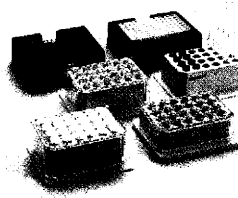
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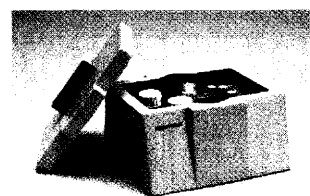
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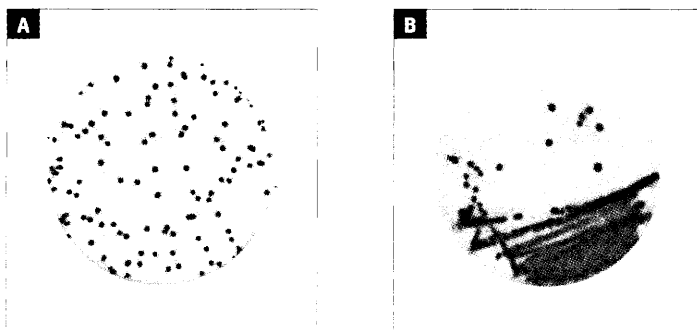
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Illustration inspired by the optical art of Victor Vasarely.



Panel A shows a typical CLONdisc plate inoculated with an aliquot of bacterial culture. **Panel B** shows a single colony streaked on a rehydrated CLONdisc plate. *Lac+* colonies appear blue due to the presence of X-gal in the growth matrix. *Lac-* colonies appear red due to the presence of TTC. Both images were obtained using an Epson 836XL flatbed scanner.

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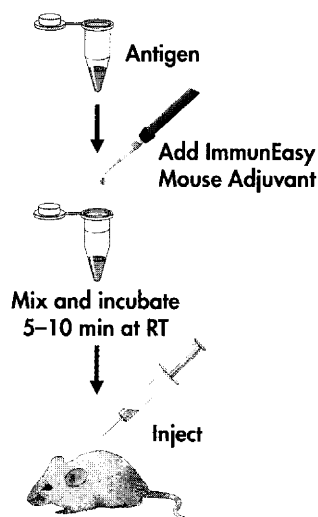


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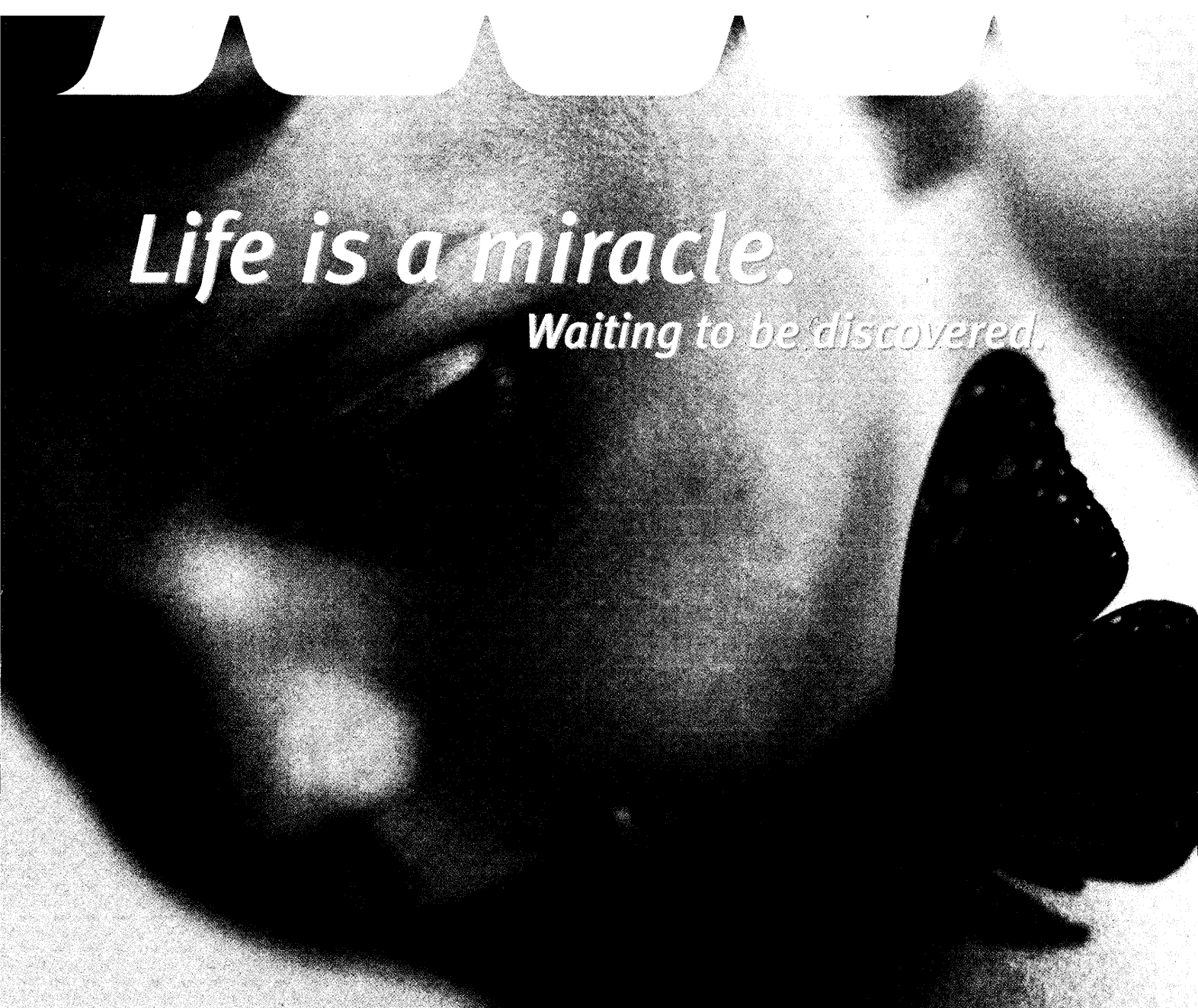
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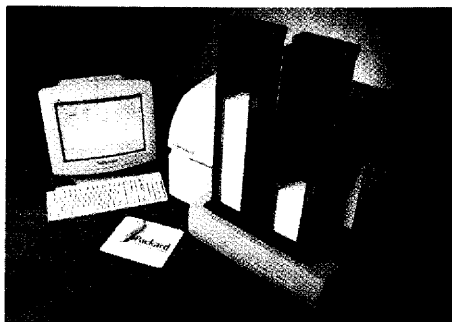
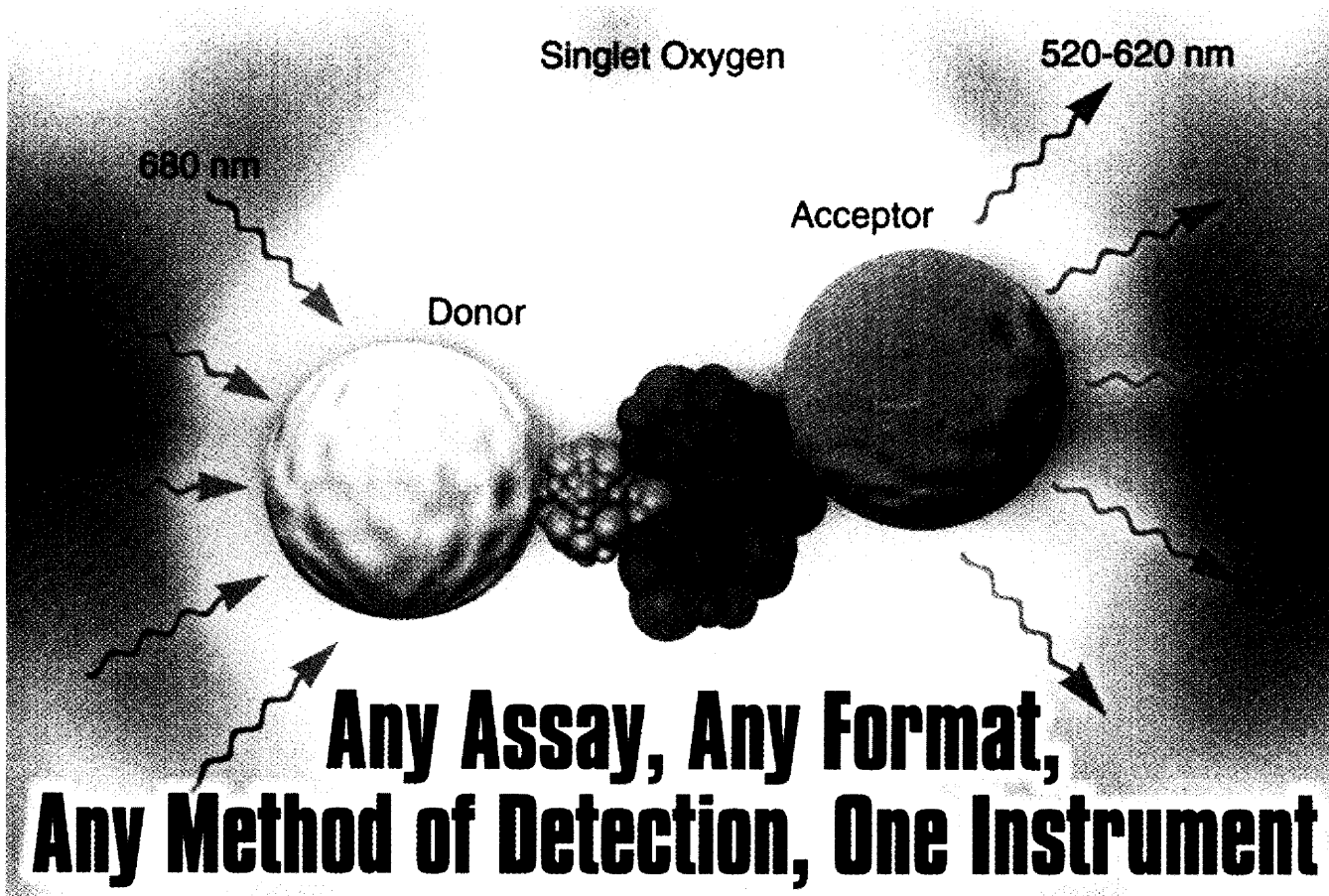
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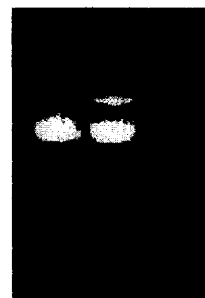
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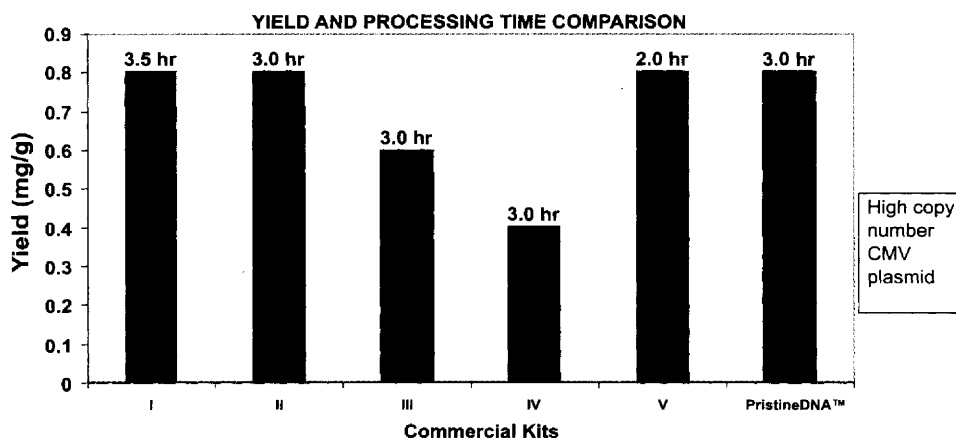
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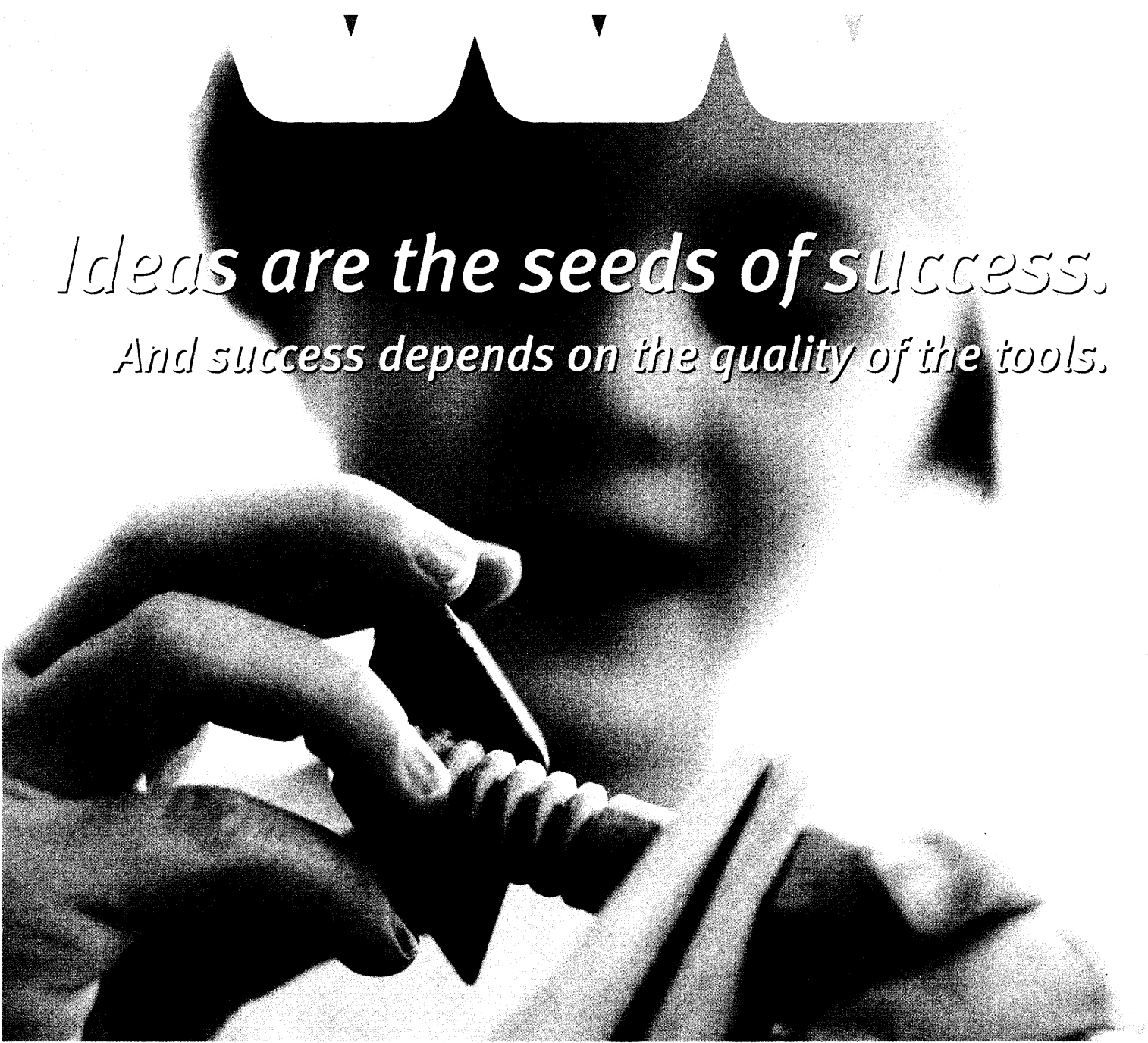
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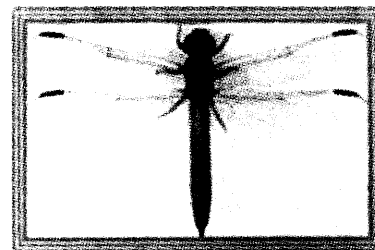
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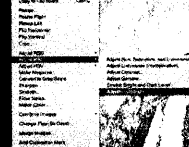
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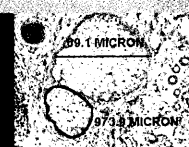
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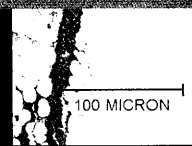
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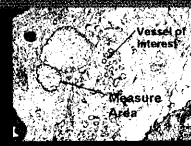
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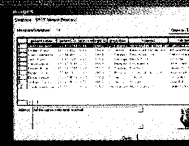
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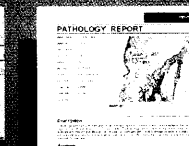
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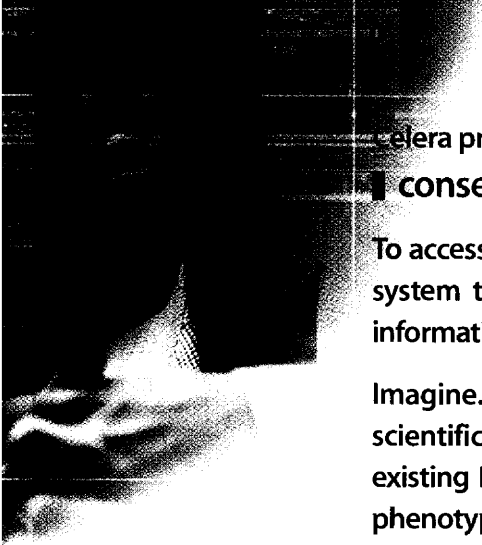
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Fig. 2

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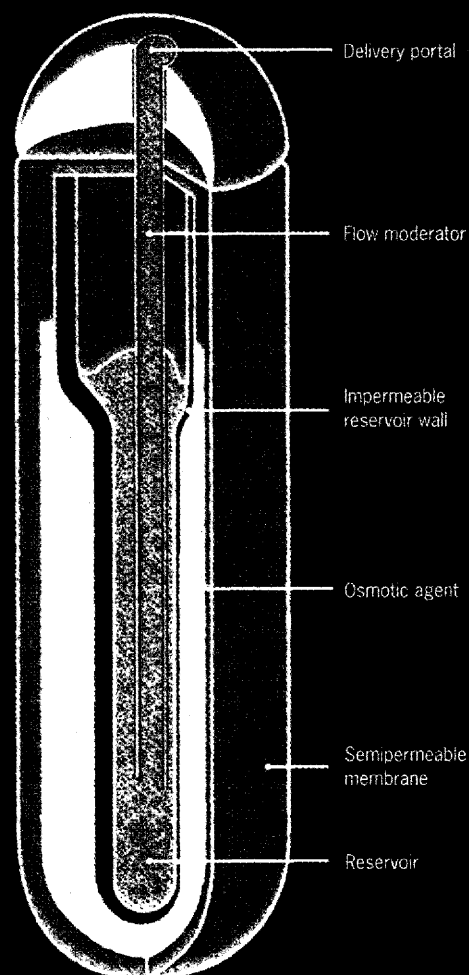
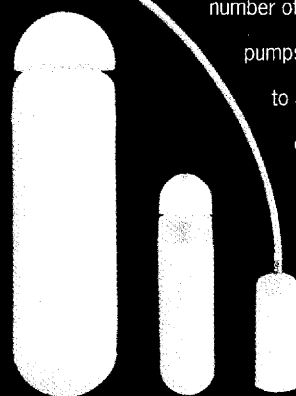
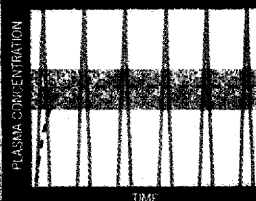


Fig. 1

The ALZET pump operates as interstitial fluid is attracted into the pump by the osmotic layer at a rate limited by the outer, semi-permeable membrane. As the osmotic layer hydrates, it compresses the flexible reservoir, which expels drug from the delivery portal of the pump.



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Fig. 3

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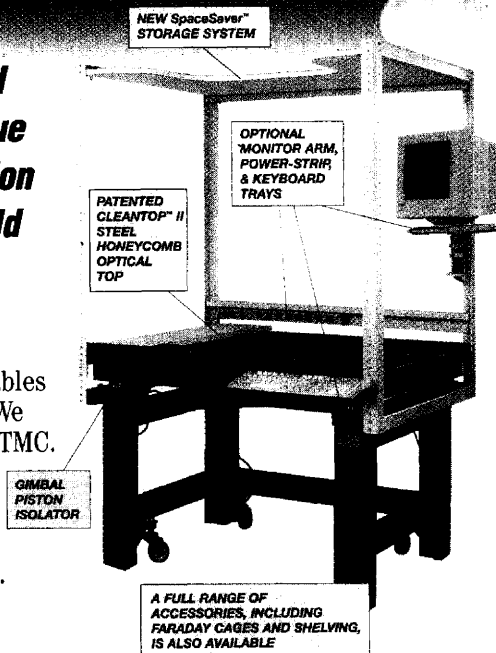
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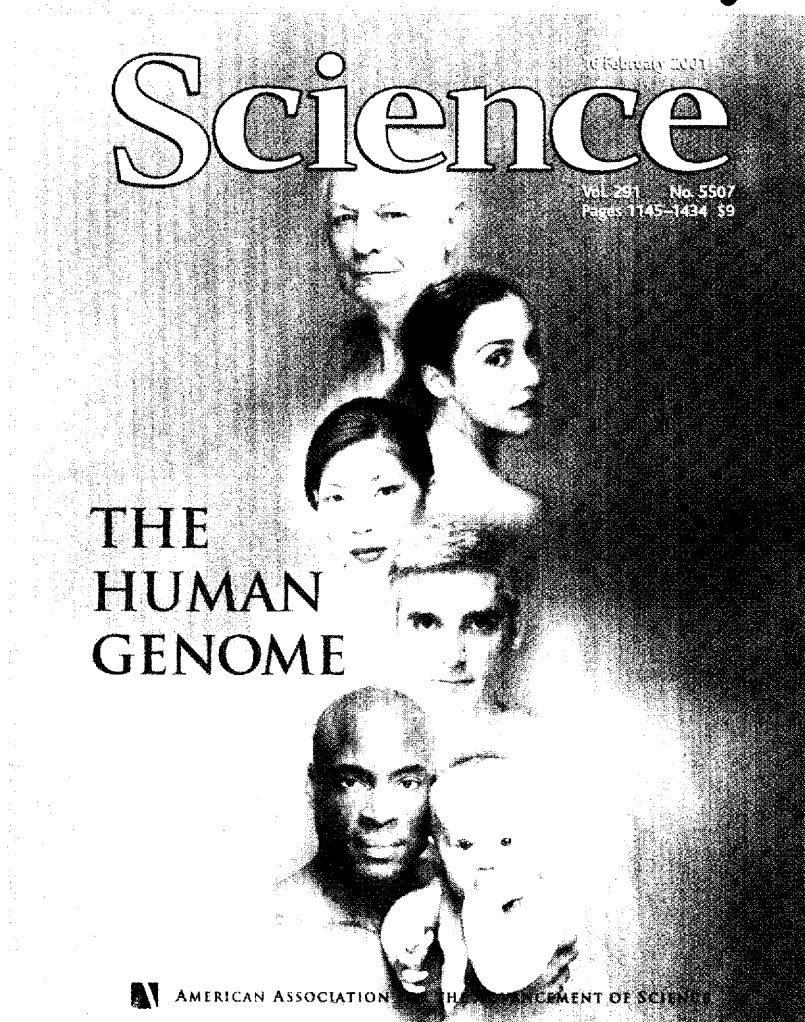
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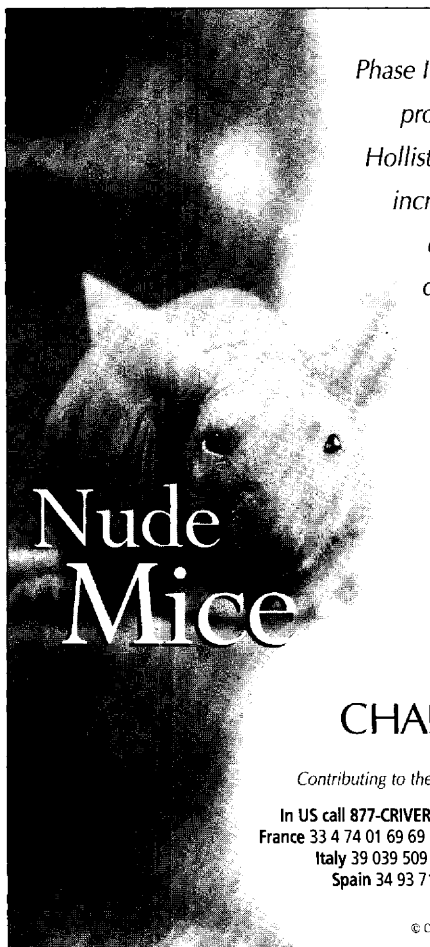


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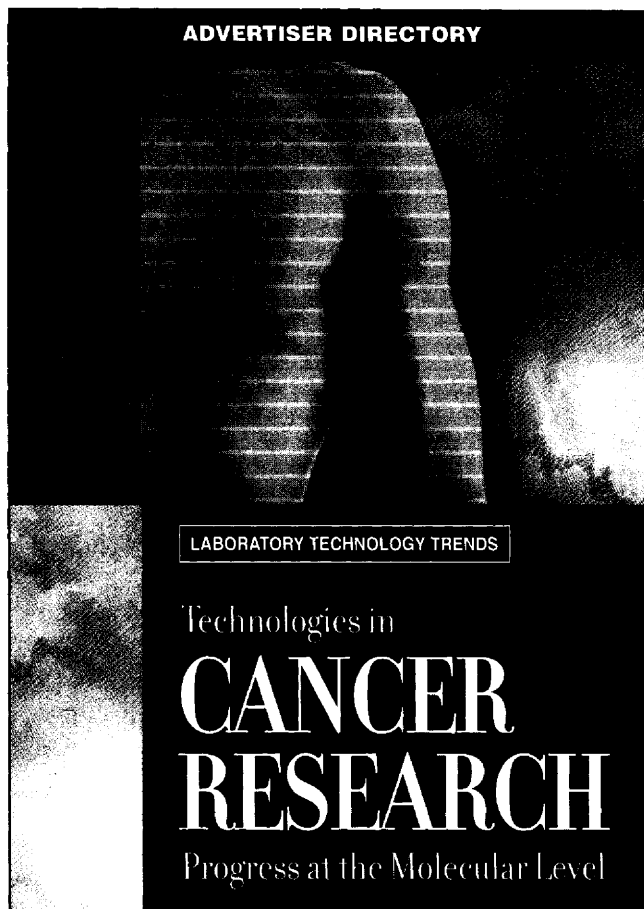
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Applications are due 1 June 2001. Winners will be announced August 2001.

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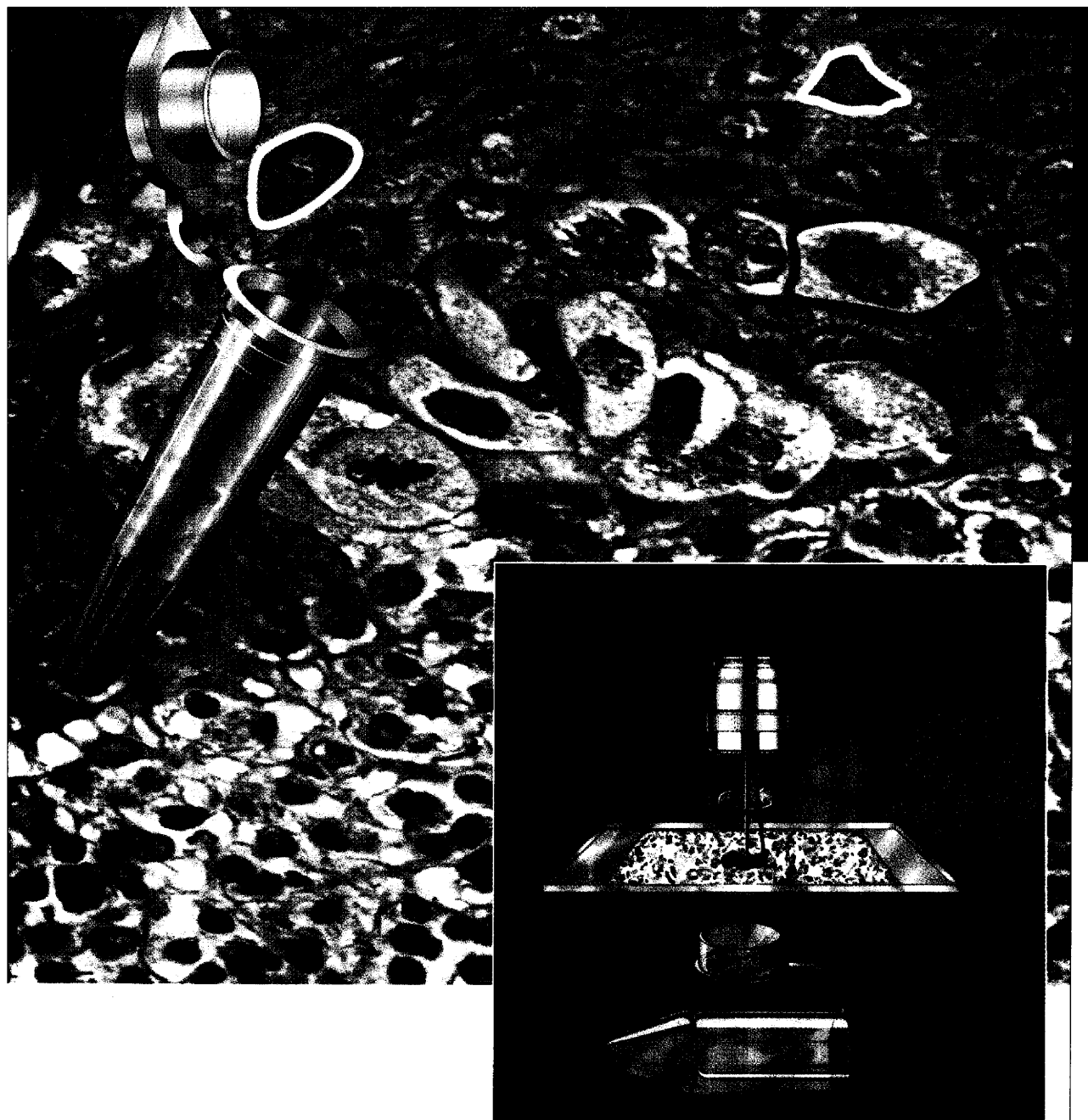
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